

Интернет-журнал «Отходы и ресурсы» <https://resources.today>
Russian Journal of Resources, Conservation and Recycling

2022, №2 Том 9 / 2022, No 2, Vol 9 <https://resources.today/issue-2-2022.html>

URL статьи: <https://resources.today/PDF/08ECOR222.pdf>

DOI: 10.15862/08ECOR222 (<https://doi.org/10.15862/08ECOR222>)

Ссылка для цитирования этой статьи:

Астратова, Г. В. Проблемы обращения твердых коммунальных отходов и ответственное потребление в зеленой экономике / Г. В. Астратова, Т. К. Руткаускас, К. В. Руткаускас // Отходы и ресурсы. — 2022. — Т. 9. — № 2. — URL: <https://mir-nauki.com/PDF/08ECOR222.pdf> DOI: 10.15862/08ECOR222

For citation:

Astratova G.V., Rutkauskas T.K., Rutkauskas K.V. Solid municipal waste treatment problems and responsible consumption in a green economy. *Russian Journal of Resources, Conservation and Recycling*, 9(2): 08ECOR222. Available at: <https://mir-nauki.com/PDF/08ECOR222.pdf>. (In Russ., abstract in Eng.). DOI: 10.15862/08ECOR222

Благодарность: Считаю необходимым поблагодарить преподавателей и студентов Института экономики и управления Уральского федерального университета имени первого Президента России Б.Н. Ельцина, кто своими ценными замечаниями, комментариями и идеями внес существенный вклад в концепцию, дизайн, сбор данных и/или анализ и интерпретацию данных.

Исследование носит инициативный характер и не имеет специального финансирования.

Acknowledgements: We consider it necessary to thank the teachers and students of the Institute of Economics and Management of the Ural Federal University named after the first President of Russia B.N. Yeltsin, who, with their valuable notes, comments and ideas, made a significant contribution to the concept, design, data collection and/or data analysis and interpretation.

The research is of an initiative nature and has no special funding.

JEL codes: R1; R2; R3; R 15; D1; M1; O15; O18

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Solid municipal waste treatment problems and responsible consumption in a green economy

Abstract. Improving the life quality of the Russian Federation population is especially relevant in the green economy in general, in the housing and communal utilities sector (further HCUS), in particular, and in the process of solving the problem of solid municipal waste (further SMW) management, in particular. The transition to a green economy is also based on responsible consumer behavior, which is an urgent and difficult task, since the theoretical and methodological basis of research is still being formed here. The purpose of the study is to identify the key problems of SMW

circulation and identify the main problems of responsible consumption in the green economy. Research methods: analysis of domestic and foreign authors' works on the stated problems; surveys of the population and experts; correlation and qualimetric analysis. Issues considered: (1) HCUS, regulatory support for responsible consumption and the problem of SMW circulation in the green economy; (2) the attitude of the population to SMW and the problems of modeling responsible consumption in the green economy. It is revealed that both abroad and in Russia there is a growing attention from the state and society to responsible consumption. It is shown that the majority of respondents noted the high efficiency of the national project "Ecology" activities. It is expected that in the very near future the business will be forced to introduce environmental standards and environmental management, create "clean" technologies, recycle and dispose of waste. The attitude of the population to SMW was studied based on the model of the individual's pro-ecological behavior: (1) identification of the behavior to be changed; (2) study of the main indicators influencing this behavior; (3) development and application of intervention tools to change behavior and reduce environmental impact; (4) evaluation of the results of the intervention. It is revealed that in Russia there is an insufficiently high level of environmental education of the population, which is associated with indicators of quality of life. The most effective ways to stimulate responsible consumption are social marketing activities and the implementation of economic tools to encourage and punish consumers.

Keywords: green economy; quality of life; ecology; housing and communal utilities sector; solid municipal waste (SMW); treatment of municipal solid waste; consumer behavior; responsible consumption; pro-environmental behavior

Introduction

Solving the problems of the population level and quality of life improving is a consistently urgent problem. This issue is of particular relevance, firstly, in the context of the proclamation and development of the green economy principles [34], and, secondly, in the field of housing and communal utility services (further — HCUS) in general and in the process of solving the problem of solid municipal waste (further — SMW) management, in particular [12].

The proclamation and development of the green economy principles presupposes the achievement of economic growth based on the simultaneous resolution of socio-economic and environmental problems of modern society [34]. In other words, together with technological progress, modernization and increased production efficiency, a green economy should contribute to ensuring social justice and improving the life quality [23], as well as reduce environmental risks in terms of impoverishment of nature [31].

The development of the green economy is especially relevant for Russia. Taking into account the negative consequences, risks and missed opportunities of the raw material model of the Russian economy, one of the key principles of the transition to a green economy is responsibility for the resources use. This is interpreted by modern economists as a responsibility to monitor, control and consumption resources at the state, business and population levels [2; 37].

It should be noted that in the Russian Federation, as in the whole world, the problem of waste is growing in proportion to the extraction of minerals and the production of various industrial, agrarian and other goods. However, unlike the USA and European countries in Russia, the problem of SMW became visible only in the 20th century, when factories began to concentrate in large cities. As it is quite rightly noted by Y.V. Ermolaeva's study [10, p. 170], the main reasons for the lag in understanding the "garbage problem" in Russia are the following factors:

- «...geographical mentality (expansion of polygons is possible due to the resources of the territory, which makes visible a delay in making a decision to switch to separate SMW collection and allows increasing the share of processing);

- low legal culture;
- the eco-culture that developed in the Soviet and post-Soviet period, characterized by an increasing rate of consumption and the cult of disposable;
- the growing private sector with different areas of responsibility and the weakening of municipal power;
- players with different value orientations: business, eco-activists, government;
- the local municipal authorities and the population perceive this problem from their own point of view, since each of the social groups forms its own system of interaction with SMW, locking itself in, and does not seek support from higher authorities;
- advantageous uncertainty and instability of the situation for the possibility of varying powers;
- lack of financial resources at the federal level;
- insufficiency of specialists in the field of SMW processing, technologists and environmentalists. As a rule, they are representatives of other specialties working in the field of waste management;
- creation of a shadow market (crime, illegal waste management procedures). The phenomenon of “garbage kings” and settlements of migrant workers and homeless workers in landfills engaged in manual sorting;
- lack of household and practical knowledge about the dangers of waste, their varieties, environmental expediency»¹.

It is obvious that the most important condition for the transition to a green economy should be the appropriate (pro-ecological) behavior of the consumer. However, changing the habitual lifestyle of the consumer to an eco-friendly, thrifty and responsible one is not only an urgent, but also a very difficult task. This is due to problems of both a normative nature and behavioral features in the conditions of a green economy, the theoretical and methodological basis of research on which is still being formed.

In connection with the above, the authors set the goal of the study: to identify the key problems of solid municipal waste management and to identify the main problems of responsible consumption in the green economy.

Methods

It was considered necessary to use the following research methods: systematization and comparison tools, analysis and synthesis, methods of statistical, correlation analysis [9; 30] and qualimetric analysis [7], as well as a survey of the population and experts.

As a methodological tool for assessing responsible consumer behavior in the green economy, the model of pro-ecological behavior of an individual was taken as a basis, which includes four main stages:

¹ Translation from Russian into English and from English into Russian here and further is made by Professor Galina V. Astratova.

1. identification of the behavior to be changed;
2. research of the main indicators influencing this behavior;
3. development and application of intervention tools to change behavior and reduce environmental impact;
4. evaluation of intervention results [20, p. 16–17].

Empirical data were obtained through a survey of the population and experts.

1. *Population survey.* The survey of the population was conducted online by using the author's questionnaire for determining the coordinate-environmental and integrated portrait of the consumer [26; 27] in order to determine the level of environmental friendliness of the residential building location, as well as to assess the organization of activities for the collection, processing, neutralization, disposal and placement of solid municipal waste and the responsibility of consumer behavior of the population in a green economy. The questionnaire was posted on social networks (WhatsApp, V Kontakte, Facebook, Odnoklassniki). A total of 2,094 people were interviewed in 2018, 2019, 2021 and 2022. The representativeness of the sample for the population survey was verified on the basis of a correlation analysis of the ratio of the specific number of respondents by age groups with the data of the Federal State Statistics Service of the Russian Federation as of 01.01.2019.

The largest number of respondents who took part in the survey falls on the age groups from 25 to 55 years. A larger number of respondents belong to the age group of 30–40 years, which is characterized by active entry into economic relations and participation in the reproduction of the population. The Pearson scale was used as the basis for determining the value of the overall correlation. The Pearson correlation coefficient (K_p) in our study was in the range of 0.41–0.42, which corresponds to its average positive value [8].

According to the author's developments [26; 27], respondents were asked to assess the quality of the living environment, or, in other words, the level of environmental friendliness of the residential building location. As a result, based on the responses received, the proportion of responses with a proper score for the row (k_j) was first determined, calculated by the ratio of the number of responses for each criterion (k_{kj}) to the total number of respondents who answered (k_r , in our case $k_r = 2094$ people) multiplied by the corresponding score (b_j) for the column. Further, the result obtained, divided by the maximum number of points (b_{max}), and determined the level of environmental friendliness of the residential building location ($V_{ecol.i}$) for each of the criteria (formula 1).

$$V_{ecol.i} = \frac{\sum_{i=1}^n k_j \times b_j}{b_{max}} \quad (1)$$

Where: $V_{ecol.i}$ — the level of environmental friendliness of the residential building location;

k_j — the proportion of responses with a proper score per row, calculated by the ratio of the number of responses for each criterion (k_{kj}) to the total number of respondents (k_r), multiplied by the corresponding score (b_j) for the column;

b_j — the corresponding score according to the evaluation criterion by column;

b_{max} — the maximum number of points for assessing the level of environmental friendliness of the residential building location (7 points were accepted in this study).

2. *Expert survey.* The expert survey was conducted in Google docs by the method of an anonymous survey presented in the author's questionnaire of a blitz survey based on value methods [5] in order to clarify certain aspects of consumer attitudes to responsible consumption in the green economy. The survey was conducted in February 2022 (122 people were interviewed). Residents of Yekaterinburg were involved as experts: specialists in the field of housing and communal utility

services, SMW collection and processing and university professors specializing in ecology, HCUS and construction.

The volume of a statistically reliable sample for an expert survey was determined based on well-known recommendations [17]. Statistical coefficients were also determined in such calculations [9; 30] as:

1. K_k is the Kramer correlation coefficient, showing the strength of the connection between two measured categorical fields. If the K_k value is less than 0.2, then although the result is statistically significant, the result is weak and the categorical fields are weakly related. If the K_k value is in the range from greater than or equal to 0.2, but less than or equal to 0.6, then the result is moderate and the relationship between the fields of average strength. If the K_k value is greater than 0.6, then although the result is strong and the categorical fields are closely related.
2. K_c is the concordance coefficient, which is a measure of the consistency of expert opinions. If the K_c value is close to 0, then the consistency of respondents' opinions is very low. If the value of the K_c is greater than 0, but not more than 0.3, then the opinions of experts are not agreed. When finding the K_c coefficient in the range from 0.3 to 0.7, the consistency is average. When the K_c value is more than 0.7, but less than 0.85, the consistency of expert opinions is defined as high. With a K_c value of more than 0.85, the consistency of expert opinions is considered very high.

The data obtained as a result of the study were processed in Microsoft Excel and Statistica programs.

Results and Discussion

We considered it necessary to look through the stated problems in the context of two key research problems:

1. Housing and communal utilities services sector, regulatory support for responsible consumption and the problem of solid municipal waste management in the green economy.
2. The attitude of the population to solid municipal waste and the problems of modeling responsible consumption in a green economy.

1. Housing and communal utilities services sector, regulatory support for responsible consumption and the problem of solid municipal waste management in the green economy.

The most important direction of modern socio-economic transformations in the Russian Federation is the reform and development of the housing sector, which creates the necessary conditions for human life. The leading industry in the housing sector is housing and communal utilities services (further HCUS), which provides housing stock maintenance, production and delivery services of HCUS to direct consumers. The main components of the concept of “living conditions” that have a direct impact on such a characteristic as “life quality” (or “quality of life”) are the housing conditions of the population, accessibility and quality services of HCUS [12; 25].

According to a number of researchers [1; 22; 32; 37], the life quality is largely determined by the state of the living environment, the properties of which, within the framework of the tasks of the green economy, depend on the choice of socio-economic and environmental strategies and tactics of applying managerial and financial mechanisms for their implementation, including the economy of material, energy and natural resources based on energy conservation, as an instrument for such a policy. A systematic approach to achieving the quality of the natural environment, goods, services,

products and quality of life through the organization of resource-saving measures, the introduction of “green” technologies, technical and economic measures is laid down in the formation of global principles: “zero waste”, “RRR” (reduce, reuse, recycling), “circular economy” (closed-cycle economy), “green economy” [33, p. 56].

It should be emphasized that the life quality of the Russian population is the object of close attention of the apparatus of state and regional administration. Thus, the Development Strategy of the Russian Federation HCUS until 2035² (hereinafter referred to as the Strategy) states that the HCUS industry is an area responsible for the living conditions of the population. As the main priorities for the development of the industry, the Strategy defines improving the life quality of the population by improving the quality and reliability of HCUS services, as well as ensuring their accessibility to the population. It should be noted that the implementation of the Strategy³ and other state program documents depends, among other things, on the general state and trends of economic development in the country as a whole and in its individual regions, in particular.

For example, in the Sverdlovsk region at the moment, the following key documents speak about the quality of life: (1) the Decree of the Sverdlovsk region Governor⁴; (2) the Concept of “New quality of life of the Urals”⁵ (hereinafter the Concept). As follows from the Concept, the goal of the life quality in the HCUS sphere is to improve the living conditions and public services of the population in the Sverdlovsk region by improving the quality and reliability of HCUS services provided to citizens, as well as improving the level of improvement of housing stock in cities and settlements in the Sverdlovsk region. To achieve this goal, it is necessary to implement the following main tasks:

1. «modernization of the housing and common utilities services complex, liquidation of the emergency housing stock, ensuring environmental safety of the activities of organizations of the housing and communal complex;
2. improving the comfort of the housing stock, the quality and reliability of housing and communal services, the efficiency of housing and communal complex management;
3. improving the system of financing and pricing in the housing and communal services market;

² Decree of the Government of the Russian Federation dated April 25, 2019 No. 240/pr. "Strategy for the development of housing and communal services of the Russian Federation for the period up to 2035" [Распоряжение Правительства РФ от 25 апреля 2019 г. № 240/пр. «Стратегия развития жилищно-коммунального хозяйства Российской Федерации на период до 2035 года»]. URL: <https://deloros-perm.ru/upload/iblock/927/%D0%A1%D1%82%D1%80%D0%B0%D1%82%D0%B5%D0%B3%D0%B8%D1%8F%20%D1%80%D0%B0%D0%B7%D0%B2%D0%B8%D1%82%D0%B8%D1%8F%20%D0%96%D0%9A%D0%A5%202035.pdf> (accessed at 16 February 2022). (In Russian).

³ Decree of the Government of the Russian Federation dated April 25, 2019 No. 240/pr. "Strategy for the development of housing and communal services of the Russian Federation for the period up to 2035". [Распоряжение Правительства РФ от 25 апреля 2019 г. № 240/пр. «Стратегия развития жилищно-коммунального хозяйства Российской Федерации на период до 2035 года»]. URL: <https://deloros-perm.ru/upload/iblock/927/%D0%A1%D1%82%D1%80%D0%B0%D1%82%D0%B5%D0%B3%D0%B8%D1%8F%20%D1%80%D0%B0%D0%B7%D0%B2%D0%B8%D1%82%D0%B8%D1%8F%20%D0%96%D0%9A%D0%A5%202035.pdf> (accessed at 16 February 2022). (In Russian).

⁴ Decree of the Governor of the Sverdlovsk Region dated 29.01.2014 No. 45-UG "On the concept of improving the quality of life of the population of the Sverdlovsk region for the period up to 2030 — "New quality of life of the Urals" [Указ Губернатора Свердловской области от 29.01.2014 № 45-УГ "О Концепции повышения качества жизни населения Свердловской области на период до 2030 года — "Новое качество жизни уральцев"]. (In Russian).

⁵ The Concept of improving the life quality of the population of the Sverdlovsk region for the period up to 2030 — “New quality of life of the Urals”, 2014 [Концепция повышения качества жизни населения Свердловской области на период до 2030 года — «Новое качество жизни уральцев», 2014]. (In Russian).

4. provision of social protection measures for low-income citizens and economic accessibility of housing and communal services for the population of the Sverdlovsk region;
5. increasing the investment attractiveness of the housing and communal complex, ensuring competition in the housing and communal services market;
6. increasing the role and responsibility of owners of premises in apartment buildings», as well as «...in the field of management of real estate owned by them; Organization of public control of the activities of organizations of the communal complex»⁶.

It is also important that both the degree of social infrastructure facilities development and the state of the environment are affected by the handling of SMW. In the Development Strategy of the Sverdlovsk Region HCUS until 2035⁷, one of the main tasks is identified as the sustainable and reliable functioning of the HCUS sphere, the solution of which is planned to be achieved, including through the implementation of measures to handle SMW and reduce the negative impact on the environment.

The creation of a comprehensive SMW management system covering all settlements of the Sverdlovsk region is the main solution to the problem of unauthorized landfills in general, and SMW in particular. The mechanisms for creating an integrated SMW management system that ensures the reduction of the negative environmental impact of economic activities in the management of consumer waste include the implementation of the tasks specified in the following main documents:

- The state program of the Sverdlovsk region on the development of housing and communal utilities services and improving energy efficiency until 2024⁸.
- The regional program in the field of production and consumption waste treatment until 2030⁹, within the framework of which the measures of the Development Strategy of the Sverdlovsk Region HCUS until 2035 are implemented, aimed at organizing activities for the collection, processing, neutralization, disposal and placement of SMW.

It is also important that, as federal experts emphasize, the main problem for Russia today is not the current situation, but the growth model and those institutional reforms that should activate the country's economic mechanism for the next 10–15 years [11]. The main discussion, which is being

⁶ The Concept of improving the life quality of the population of the Sverdlovsk region for the period up to 2030 — “New quality of life of the Urals”, 2014 [Концепция повышения качества жизни населения Свердловской области на период до 2030 года — «Новое качество жизни уральцев», 2014]. (In Russian).

⁷ Development strategy of housing and communal services sector of the Sverdlovsk region until 2035. Resolution of the Government of the Sverdlovsk Region dated 02/21/2019 No. 110-PP (as amended on 12/29/2021). [Стратегия развития жилищно-коммунального хозяйства Свердловской области до 2035 года. Постановление Правительства Свердловской области от 21.02.2019 № 110-ПП (с изменениями на 29.12.2021)]. URL: <http://www.pravo.gov66.ru> (accessed at 16 February 2022). (In Russian).

⁸ On the approval of the state program of the Sverdlovsk region "Development of housing and communal services and improvement of energy efficiency in the Sverdlovsk region until 2024". Approved by the Decree of the Government of the Sverdlovsk region dated 29.10.2013 No. 1330-PP [Об утверждении государственной программы Свердловской области «Развитие жилищно-коммунального хозяйства и повышение энергетической эффективности в Свердловской области до 2024 года». Утверждено постановлением Правительства Свердловской области от 29.10.2013 № 1330-ПП]. URL: <http://www.energy.midural.ru> (accessed at 16 February 2022). (In Russian).

⁹ On approval of the regional program in the field of production and consumption waste management in the Sverdlovsk Region, including solid municipal waste, for 2019–2030: Order of the Ministry of Energy and Housing and Communal Services of the Sverdlovsk Region dated 25.05.2018 No. 225 [Об утверждении региональной программы в сфере обращения с отходами производства и потребления на территории Свердловской области, в том числе с твердыми коммунальными отходами, на 2019–2030 годы: приказ Министерства энергетики и жилищно-коммунального хозяйства Свердловской области от 25.05.2018 № 225]. URL: <http://www.energy.midural.ru> (accessed at 16 February 2022). (In Russian).

conducted on behalf of the Russian Federation President, on structural modernization and consolidation of economic growth [11], just assumes the introduction of the principles of green economy and responsible consumption [23; 34; 37].

We consider it necessary to note that ecology is, on the one hand, the sphere of activity of the green economy. On the other hand, ecology is a subject of scientific and industrial activity in the field of interrelations between the environment, humans and other living organisms, as well as in the field of organization and functioning of biological systems at various levels. Accordingly, ecology is a very complex and multifaceted industry, even for specialists, since it requires a high level of professional competencies. In this case, responsibility for the use of environmental resources as a key principle of the transition to a green economy involves the development and availability of standards, instructions and methodological materials for consumers, both legal entities and individuals. That is why if such concepts as “environmental management”, “environmental marketing” and “ISO standards” have long existed for Russian and foreign companies [1; 4; 16; 29] in the field of production and resource management, for ordinary citizens, regulations on environmental consumption do not exist in all countries, and in the Russian Federation, for example, such a regulatory framework is still being formed.

So, in Russia, the state policy related to the separation of SMW took place in the USSR, and was represented by such activities as the mass collection and processing of waste paper, glass and scrap metal. Then, for quite a long time, there was no attempt at regulatory regulation of issues on this issue until 2017, when the so-called “garbage reform” appeared. This reform is based on the Federal Law “On Production and Consumption Waste”¹⁰, adopted in 1998 and edited in 2017–2019.

According to the “garbage reform”, a phased ban on the disposal of certain types of waste (containing mercury and heavy metals, batteries from appliances, etc.) at landfills is being introduced in the Russian Federation, and in 2018 the national Ecology project [21, p. 49] was approved, including such basic measures as:

- increase in the share of SMW aimed at processing in the total volume of SMW formed by 38 in 2021 to 60 % in 2024;
- creation of hazardous waste processing complexes in 85 subjects of the Russian Federation;
- implementation of 23.1 million tons of waste and fractions disposal capacity after SMW treatment will be put into commercial operation by the end of 2024;
- 37.1 million tons of SMW processing capacity will be put into commercial operation by the end of 2024.

Household waste sorting activities are already being applied in practice in Udmurtia, Kaluga, Moscow, Nizhny Novgorod, Sverdlovsk and other regions, and in the coming years it is planned to extend this experience to the whole country. It is supposed to stimulate the population to separate SMW collection by reducing tariffs for separating SMW and introducing fines for those violating this separation [19].

It is expected that in the modern realities of the growing attention from the state and society to environmental consumption in the very near future, business will be forced to switch to a model of responsible consumption, that is, to focus not only on making a profit, but also on protecting the

¹⁰ Federal Law "On Production and Consumption Waste". Adopted by the State Duma on May 22, 1998. Approved by the Federation Council on June 10, 1998. [Федеральный закон «Об отходах производства и потребления». Принят Государственной Думой 22 мая 1998 года. Одобрен Советом Федерации 10 июня 1998 года]. URL: http://www.consultant.ru/document/cons_doc_LAW_19109/ (accessed at 10 February 2022). (In Russian).

ecology. Accordingly, environmental protection will be implemented by business through the introduction of environmental standards, the introduction of environmental management, the creation of “clean” technologies and circular production, the implementation of waste recycling and disposal processes, etc. events [15; 24; 33].

2. The attitude of the population to solid municipal waste and the problems of modeling responsible consumption in a green economy.

It should be noted that the presence of environmental norms and regulations, as well as knowledge of these norms, do not guarantee socially responsible consumption [36]. At the same time, social norms (or the idea of what most people do) and moral norms (or the idea of what a person should do) are much stronger motivating factors for changing human behavior in the context of responsible, thrifty consumption. Moreover, the actions of an individual that is perceived by society as useful, important and generally accepted are more likely to be perceived and supported by society than those that are considered as someone else's responsibility (responsibility of the state, firms, etc.). The above illustrates the fact that for over 30 years abroad, the environmental or pro-environmental behavior of an individual has been actively studied in the context of a fairly new branch of knowledge for Russia, i.e. environmental psychology [1; 20; 35].

At the same time, there is evidence that if preventive actions are invisible to others, then social norms develop poorly or do not develop at all. For example, the call to buy less and, as a result, throw out less waste does not always work [1]. Or the call for SMW sorting, because it allows to effectively managing the ecology of the external environment, is also not always effective. This is due to the fact that, as is known, the contribution of SMW to the total amount of greenhouse gases is minuscule (5 %, according to various estimates), while households (primarily food and consumption), as well as transport (logistics), industrial production and agriculture produce significantly more emissions into the environment [6; 29]. Thus, in the USA alone, approximately 30 % of the food produced is thrown away, and a significant part of this waste arises precisely from the actions of consumers [1]. This is also confirmed by very impressive data on the volume of food waste produced by households in different countries in 2019–2021 (fig. 1).

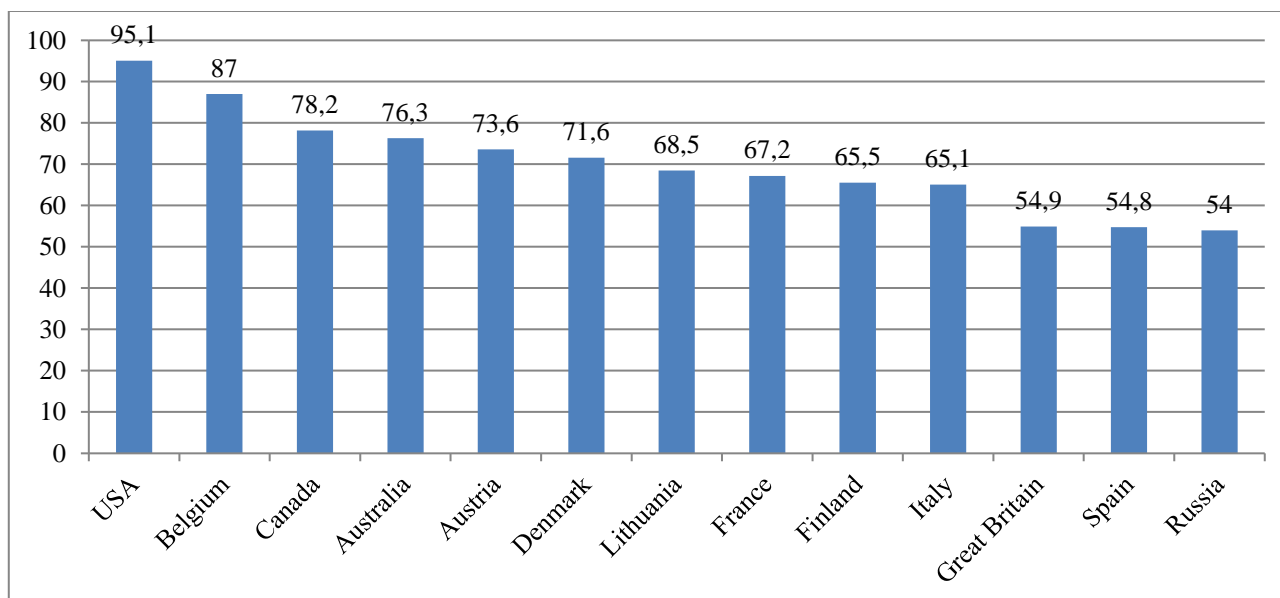


Figure 1. The volume of food waste produced by households in a number of countries, in kg per capita (compiled by the authors based on the source [3])

Рисунок 1. Объем пищевых отходов, производимых домохозяйствами ряда стран, в кг на душу населения (составлено авторами на основе источника [3])

In the field of HCUS, waste from consumed products, works, services rendered have a low level of environmental hazard and at the same time the greatest resource potential, determining technical and economic conditions, as well as the possibility and permissibility of reuse. An important factor is HCUS's need for materials and raw materials that can be manufactured using a wide range of different types of secondary resources extracted from SMW. As a result, conditions are being created in the urban economy system for the implementation of a closed-cycle economy that is successfully functioning in the EU, USA, Japan and China [1; 33; 37].

Based on the results of the analysis of Russian research and foreign experience, it was considered appropriate to study the data of the regional operator for handling SMW on the example of the Yekaterinburg Municipal Unitary Enterprise (EMUP) “Spetsavtobaza” of the Sverdlovsk region. The enterprise EMUP “Spetsavtobaza” is the largest regional operator for the treatment of solid municipal waste in the territory of the Eastern Administrative and Production Association (APO-3) of the Sverdlovsk region. EMUP “Spetsavtobaza” serves 34 municipalities, which is 46.5 % of their total number with a population of 2,758 thousand inhabitants or 64.3 % of the total population of the Sverdlovsk region (4,290.1 thousand people at the end of 2020), has 278 units of special equipment, 12 accommodation facilities (landfills), 9 waste sorting stations, 3 waste sorting complexes. The SMW collection, processing, disposal and disposal activities of the enterprise are characterized by the data presented in table 1.

Table 1 / Таблица 1

Processing and placement of SMW in EMUP “Spetsavtobaza”

Обработка и размещение SMW в ЕМУП «Спецавтобаза»

Type of work with SMW	2019		2020		11 months of 2021	
	tons	%	tons	%	tons	%
Accepted	933130	100,0	955830	100,0	888505	100,0
Processed	6571	0,7	99551	10,4	28174	3,2
Disposed	–	–	22940	2,4	7108	0,8
Placed	926559	99,3	833339	87,2	853223	96,0

Compiled by the authors based on the company's corporate data / Составлено авторами, исходя из корпоративных данных компании

From the given data, table 1 it can be seen that the volumes for the collection, processing, disposal and placement of SMW are increasing annually. For more efficient operation of the enterprise, since 01.07.2020, separate waste collection (hereinafter SWC) has been introduced on the territory of 8 municipalities on the principle of dual and multi-fractional accumulation. At sites where the SWC project has been implemented, containers are marked with special stickers indicating which type of waste needs to be stored in a particular tank. From such container sites, waste is taken out by various special vehicles. SWC on the principle of dual accumulation is produced in two types of containers: sortable and unsorted waste. Sorted waste is collected as it accumulates and taken to waste sorting complexes, unsorted ones is collected in the usual mode, in accordance with Sanitary Rules and Regulations and sent to the landfill. SWC on the principle of multi-fractional accumulation is conducted by fractions. In the classic version, it is plastic, metal, waste paper and glass. Secondary material resources are exported to waste sorting complexes and after sorting are transferred to the processor. Unsorted waste is taken by the regional operator to the landfill.

Since 2021, the regional environmental project “Green Way” has been implemented in Yekaterinburg by the EMUP “Spetsavtobaza” together with the Department of Education and Youth Policy, the Ministry of Energy and Housing and Communal Utilities Services. This project involves separate accumulation and collection of SMW in educational institutions. The regional operator interacts with consumers and supervisory authorities on requests.

The obvious successes of the regional operator in the field of SMW collection and separation, however, do not allow us to say that in the Russian Federation as a whole and in certain regions of the country (in the Sverdlovsk region, for example), a model of pro-ecological consumption has been formed. Moreover, speaking about the formation of responsible behavior in a green economy, it should be noted that modeling such behavior is a very serious problem with interdisciplinary aspects. In particular, O.V. Kashcheev and co-authors note that, firstly, a nationwide transition from the concept of mass consumption to the concept of responsible consumption has not been formed in Russia. Secondly, that the Russian consumer is not yet sufficiently informed about the model of responsible consumption, and therefore is not ready to accept and follow it [13].

In addition, new concepts and tools of “green marketing” and “green management” are needed in the green economy, as well as “ISO standards” [1; 4; 16; 29], as well as new terms such as “green or eco-friendly or responsible retail” and “green or eco-friendly or responsible retailer” [13; 14]. Accordingly, a “green” retailer is a retail trade organization that comprehensively uses environmental initiatives in its activities, allowing it to reduce the negative impact on the environment, optimize costs, increase the loyalty of consumers and employees, and strengthen the image among buyers, suppliers and partners [14].

In this regard, quite rightly, in our opinion, A.Z. Korobkin and A.Ya. Yakimik note that the following types of activities can be attributed to environmental initiatives in “green” retail:

- “development of environmental management;
- use of the organization's environmental policy;
- providing an assortment of eco-certified products;
- competent customer information;
- efficient use of energy and water resources;
- the use of environmentally preferable packaging of goods;
- competent waste management, their separate collection and transfer for recycling” [14].

Accordingly, we believe that the concepts of “green” retail or “green” retailer and “environmental initiatives in green retail” can be fully attributed to the sale of housing and communal utilities services.

Speaking about the problem of modeling responsible consumption in a green economy, it should be noted that in the most general form, modeling consumer behavior is a complex process that depends on a variety of external and internal factors affecting the individual. Any consumer behavior begins with awareness of the problem, awareness of the need and information search, and then there is a comparison of market alternatives, purchase of goods or services and post-purchase evaluation [28]. As shown in our earlier studies, consumer behavior very much depends on the type of market, product and the specifics of market forces affecting the individual, which is especially evident in the housing and communal utilities services market [5; 18; 26; 27]. Accordingly, in order to start modeling or forming responsible consumption, it is necessary to have at least a minimal idea about its algorithm.

At the moment, it is known that in the most general form, the model of an individual's pro-ecological behavior includes four main stages:

1. Identification of the behavior to be changed.
2. Research of the main indicators influencing this behavior.
3. Development and application of intervention tools to change behavior and reduce environmental impact.

4. Evaluation of intervention results [20, p. 16–17].

In this regard, it was considered expedient to study the behavior of the Russian consumer, relying on these four stages as methodological guidelines.

1. Identification of the behavior to be changed.

Our research has shown that both experts and the public recognize that the level of ecological culture of consumers in Russia still leaves much to be desired (fig. 2).

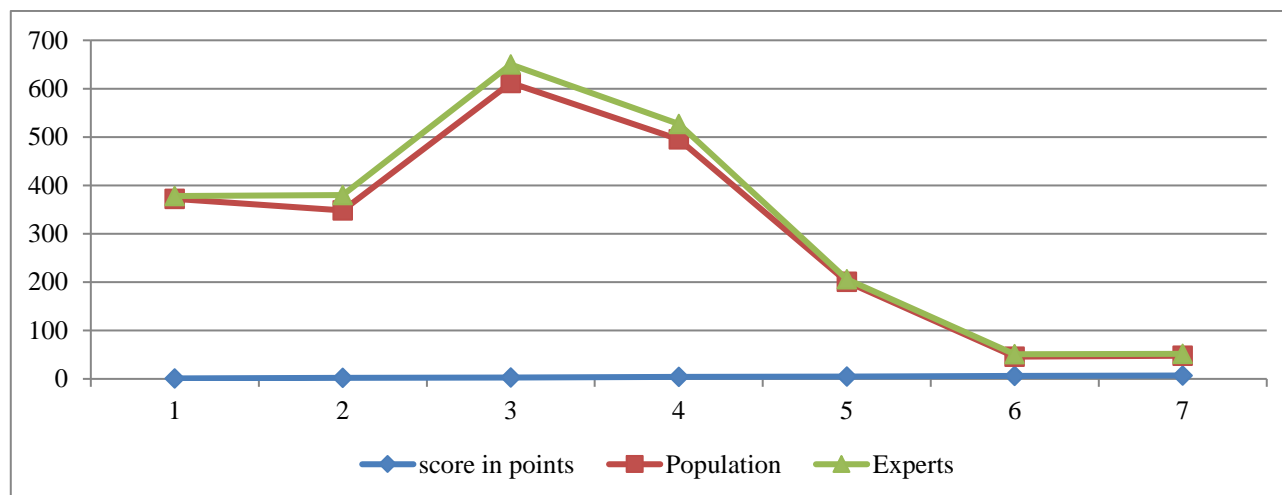


Figure 2. Assessment of the level of ecological culture of the population, in points, where 7 — max, and 1 — min assessment ($N_e = 122$; $n_e = 121$; $N_c = 2094$; $n_c = 2090$; $K_k = 0,15$; $K_p = 0,41$; $K_c = 0,87$)¹¹ (compiled by the authors based on a survey of experts and the public)

Рисунок 2. Оценка уровня экологической культуры населения, в баллах, где 7 — max, а 1 — min оценка ($N_e = 122$; $n_e = 121$; $N_c = 2094$; $n_c = 2090$; $K_k = 0,15$; $K_p = 0,41$; $K_c = 0,87$)¹¹ (составлено авторами на основе опроса экспертов и населения)

It is important that the insufficient level of environmental education of the population takes place against the background of insufficiently high socio-economic indicators of people's standard of living. Thus, we found that with an increase in the share of expenses for housing and communal services (from 40 % and above the average monthly total income), the share of negative attitude towards payment for waste collection increases sharply (up to 47 % of respondents). Although the majority of respondents indicate that utility costs are in the range of 10 to 40 % of the average monthly total income and, accordingly, the share of negative attitude to SMW collection here is no more than 17 % (fig. 3).

¹¹ Here and further:

Symbols: N is the total number of respondents; n is the number of responses received; K_k is the Kramer correlation coefficient (average value); K_p is the Pearson correlation coefficient (average value); K_c is the concordance coefficient (consistency of respondents' opinions; average value); *index e* refers to experts, and *index c* refers to consumers.

Здесь и далее:

Условные обозначения: N — общее количество опрошенных; n — число полученных ответов; K_k — корреляционный коэффициент Крамера (среднее значение); K_p — корреляционный коэффициент Пирсона (среднее значение); K_c — коэффициент конкордации (согласованности мнений респондентов; среднее значение); *индекс e* относится к экспертам, а *индекс c* — к потребителям.

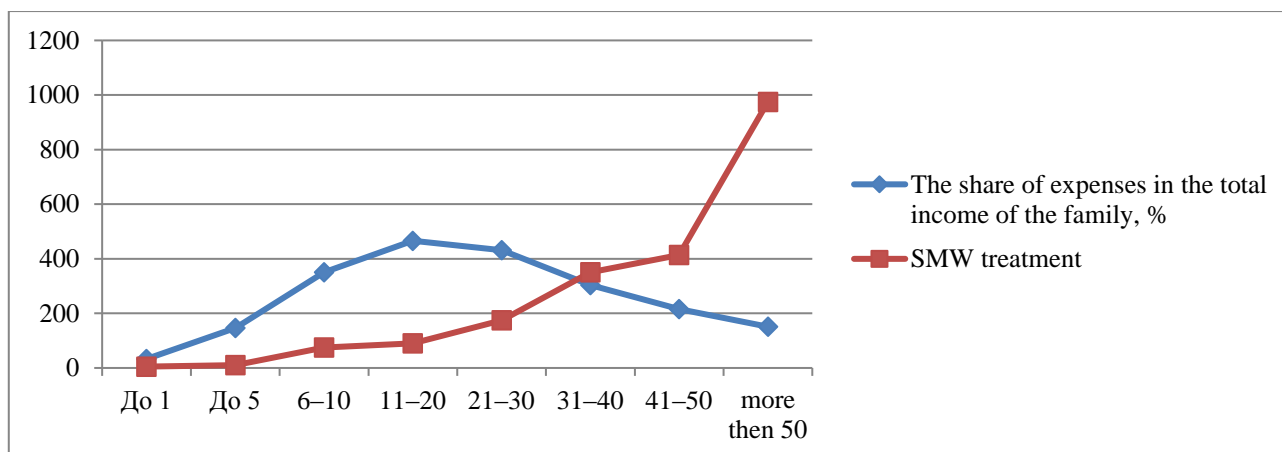


Figure 2. The ratio of the share of HKUS expenses in the average monthly total income of the population and the share of negative attitude to the item of SMW expenses ($N_c = 2094$; $n_c = 2090$; $K_k = 0,15$; $K_p = 0,41$) (compiled by the authors based on a survey of the public)

Рисунок 3. Соотношение удельного веса расходов на оплату услуг ЖКХ в среднемесячном совокупном доходе населения и доли негативного отношения к статье расходов на оплату ТКО ($N_c = 2094$; $n_c = 2090$; $K_k = 0,15$; $K_p = 0,41$) (составлено авторами по результатам опроса населения)

The attitude of the population to the separate accumulation of solid municipal waste is also important. On the one hand, as experts note, this issue was well dealt with during the USSR (9.8 % of responses) and this issue should have been dealt with long ago (31.1 %); and in general, the absolute majority (54.0 %) of experts say that separate accumulation of SMW is necessary (fig. 4).

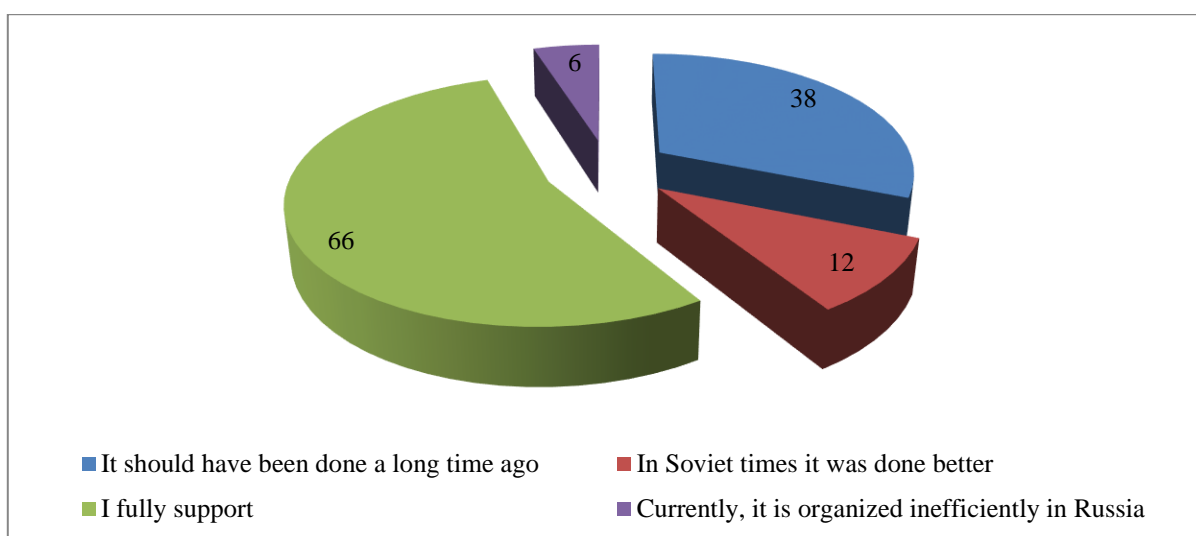


Figure 4. Distribution of experts' answers to the question: "How do you feel about sorting/separating household waste?" ($N_e = 122$; $n_e = 122$; $K_k = 0,14$; $K_p = 0,42$; $K_c = 0,75$) (compiled by the authors based on a survey of the experts)

Рисунок 4. Распределение ответов экспертов на вопрос: «Как Вы относитесь к сортировке /разделению бытовых отходов?» ($N_e = 122$; $n_e = 122$; $K_k = 0,14$; $K_p = 0,42$; $K_c = 0,75$) (составлено авторами по результатам опроса экспертов)

Respondents were also asked to assess the quality of the living environment, or, in other words, to assess the level of environmental friendliness of their apartment building location (tabl. 2).

Table 2 / Таблица 2

Assessment of the level of environmental friendliness of a residential building location, in points, where 0 — min, 1 — max value ($N_c = 2094$; $n_c = 2093$; $K_k = 0,16$; $K_p = 0,42$)

Оценка уровня экологичности места расположения жилого дома, в баллах, где 0 — min, 1 — max значение ($N_c = 2094$; $n_c = 2093$; $K_k = 0,16$; $K_p = 0,42$)

Criterion of environmental friendliness of the place of residence	Level of environmental friendliness of a residential building location
Air pollution	0.47
Noise pollution	0.49
Acid precipitation	0.46
Proximity of harmful industries	0.46
Proximity to landfills	0.47
The risk of man-made accidents and catastrophes	0.54
Smog frequency	0.46
Number of green spaces	0.55
Pollution of reservoirs	0.46
Pollution by landfills	0.43
Environmental friendliness of materials at home	0.45
The energy efficiency level of the house	0.40
The threat of stray animals, including rodents	0.44
Proximity to animal burial sites	0.49
Presence of insects (cockroaches, etc.)	0.46
Environmental stress	0.60

Compiled by the authors based on a survey of the public / Составлено авторами по результатам опроса населения

It follows from table 2 that proximity to landfills and pollution by landfills significantly reduce the level of environmental friendliness of the place of residence. Moreover, it is obvious, in our opinion, that if a person lives in an ecologically unfavorable place, then the formation of his ecological culture, in particular, and pro-ecological behavior, in particular, will be accompanied with significant difficulties.

2. Research of the main indicators influencing consumer behavior.

The data of our online survey revealed that the negative attitude of the population towards SMW payments is due to the opacity of the cost of these types of services, since the consumer does not know what he pays for, and what kind of expenses each of these items includes (fig. 5).

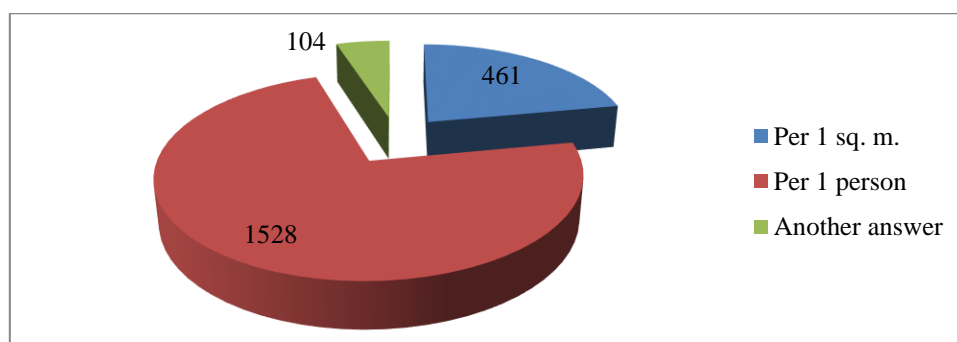


Figure 5. Distribution of payment types for SMW by the population ($N_c = 2094$; $n_c = 2093$; $K_k = 0,16$; $K_p = 0,42$) (compiled by the authors based on a survey of the public)

Рисунок 5. Распределение видов оплаты населением за ТКО ($N_c = 2094$; $n_c = 2093$; $K_k = 0,16$; $K_p = 0,42$) (составлено авторами по результатам опроса населения)

It follows from figure 5 that respondents pay for communal services in the field of handling SMW mainly per 1 person, i.e. 73 %. At the same time, 20 % of respondents have payments for SMW collection; and it is about 50–100 rubles per month.

On the other hand, a survey of the population revealed that about 14 % of respondents fundamentally disagree to share SMW. The arguments “against” are, in the opinion of the population, the opacity of payments, the incompetence of responsible organizations (SMW sorted by the population are dumped by SMW collectors into one container during export), the lack of containers for sorting, lack of material incentives for environmental behavior, etc. (fig. 6).

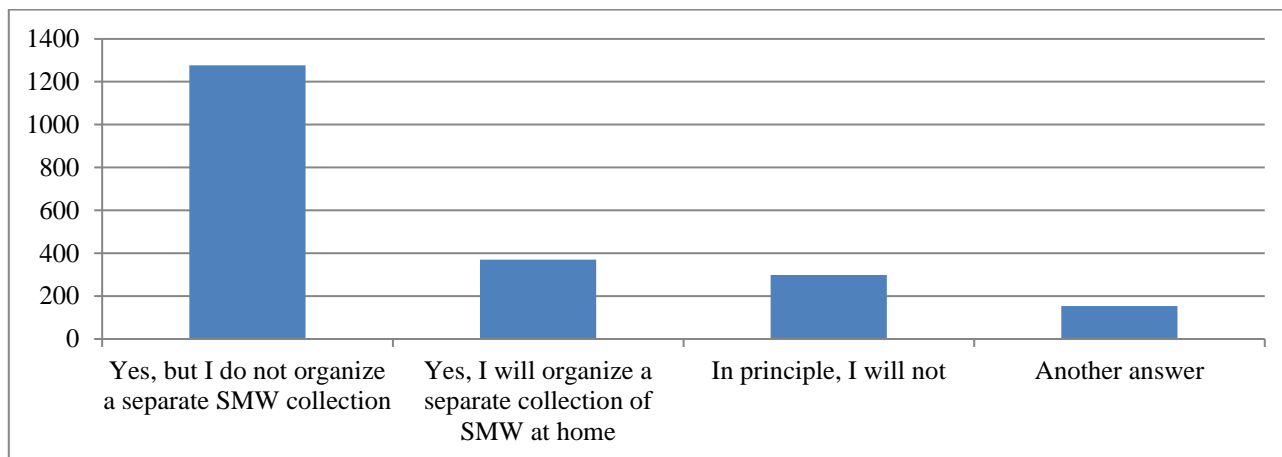


Figure 6. Orientation of the population to separate accumulation of SMW at home ($N_c = 2094$; $n_c = 2092$; $K_k = 0,15$; $K_p = 0,41$) (compiled by the authors based on a survey of the public)

Рисунок 6. Ориентированность населения на раздельное накопление ТКО в домашних условиях ($N_c = 2094$; $n_c = 2092$; $K_k = 0,15$; $K_p = 0,41$) (составлено авторами по результатам опроса населения)

Table 3 / Таблица 3

The reasons for the reluctance of the population to share SMW, according to experts (in descending order) ($N_e = 122$; $n_e = 122$; $K_k = 0,13$; $K_p = 0,41$; $K_c = 0,74$)

Причины нежелания населения разделять ТКО, по мнению экспертов (в порядке убывания) ($N_e = 122$; $n_e = 122$; $K_k = 0,13$; $K_p = 0,41$; $K_c = 0,74$)

List of reasons	Number of responses ¹²
Lack of social marketing tools that affect consumer awareness	61
The infrastructure of modern garbage collectors is not available to some consumers	52
People delegate responsibility for collecting SMW to someone (the state, business, society), but not personally to themselves	45
Collecting SMW is not the most effective solution to the SMW problem	23
People are not ready to share SMW due to low ecological culture	14
People are ready to solve the problem, but infrastructure is needed, and there is none	10
There is no special equipment on the ground, they will be collected in one tank	9
People are not ready (do not want) to understand the problem	8

Compiled by the authors based on a survey of the experts / Составлено авторами по результатам опроса экспертов

¹² Respondents had the opportunity to choose several answers.

During the survey of experts, we also obtained other reasons for the reluctance of the population to share SMW (tabl. 3).

3) Development and application of intervention tools to change behavior and reduce environmental impact.

In order to understand the right course of action in terms of developing and applying intervention tools to change behavior and reduce environmental impact, experts were asked about the most effective ways to motivate the population to separate SMW (fig. 7).

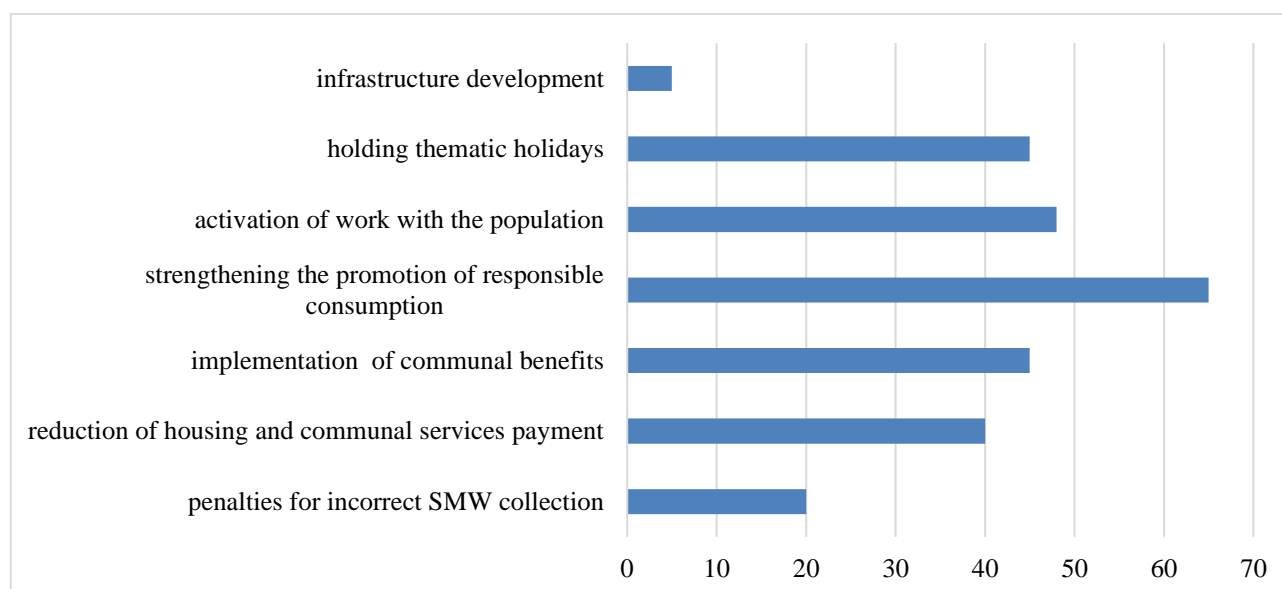


Figure 7. Distribution of experts' answers to the question: "What ways of motivating consumers to split SMW do you consider effective?" ($N_e = 122$; $n_e = 120$; $K_k = 0,13$; $K_p = 0,41$; $K_c = 0,84$) (compiled by the authors based on a survey of the experts)

Рисунок 7. Распределение ответов экспертов на вопрос: «Какие способы мотивации потребителей к разделению ТКО Вы считаете эффективными?» ($N_e = 122$; $n_e = 120$; $K_k = 0,13$; $K_p = 0,41$; $K_c = 0,84$) (составлено авторами по результатам опроса экспертов)

It follows from Figure 7 that the most effective ways of stimulating includes social marketing measures and the introduction of economic incentive tools (utility benefits and reduced payment for HCUS) and punishments for consumers (fines for improper collection of SMW). It is obvious that with the development of the infrastructure of the housing and communal utilities complex, the listed mechanisms of motivating the population to responsible consumption will be increasingly in demand.

4) Evaluation of intervention results.

Our study was not aimed at developing tools for influencing consumers and evaluating the results of this intervention, since the goal was to identify the key problems of municipal solid waste treatment and identify the main problems of responsible consumption in a green economy.

However, since Russia has developed a national project "Ecology" [21, p. 49], which includes a set of measures to work with SMW, it was considered advisable to find out how effective, according to experts, the main tools of this project are (fig. 8).

As follows from figure 8, almost more than half of the respondents noted the high efficiency of the national project "Ecology" activities.

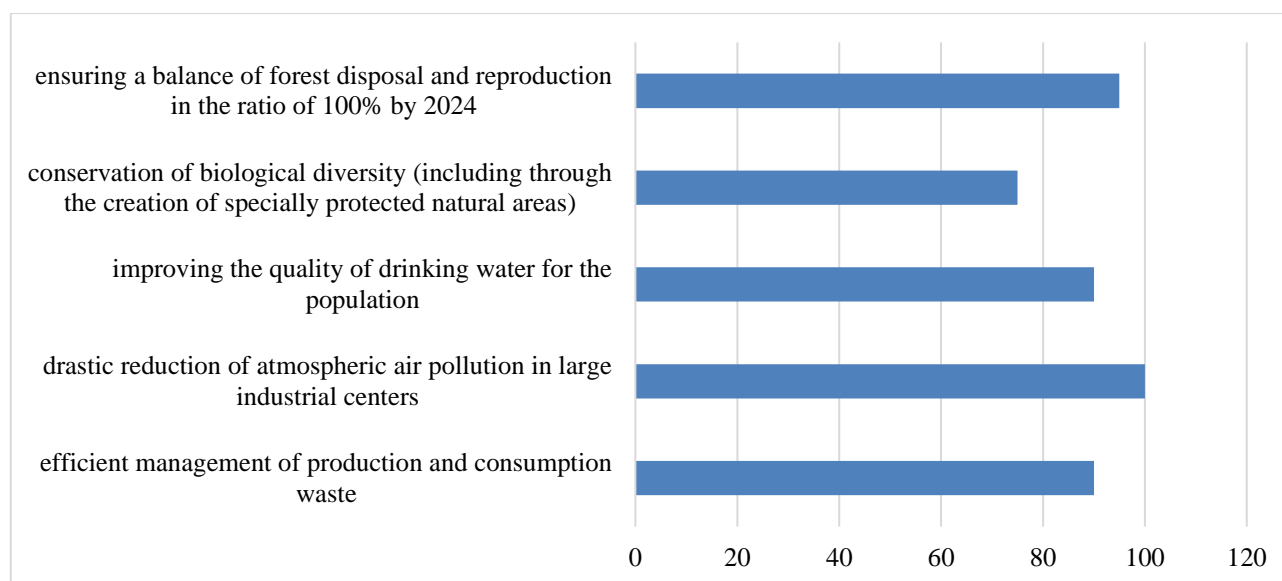


Figure 8. Experts' assessment of the national project "Ecology" main directions effectiveness¹³ ($N_e = 122$; $n_e = 118$; $K_k = 0,11$; $K_p = 0,42$; $K_c = 0,73$) (compiled by the authors based on a survey of the experts)

Рисунок 8. Оценка экспертами эффективности основных направлений национального проекта «Экология»¹³ ($N_e = 122$; $n_e = 118$; $K_k = 0,11$; $K_p = 0,42$; $K_c = 0,73$) (составлено авторами по результатам опроса экспертов)

Conclusions

The conducted research has a comprehensive approach based on the theoretical and methodological provisions of domestic and foreign authors in context of green economy, responsible consumption and pro-ecological consumer behavior in terms of solid municipal waste management.

The purpose of the study was to identify the key problems of solid municipal waste treatment and identify the main problems of responsible consumption in a green economy. The stated problems are considered in the context of two key problems of the study: (1) housing and communal services, regulatory support for responsible consumption and the problem of solid municipal waste management in the green economy; (2) the attitude of the population to SMW and the problems of modeling responsible consumption in a green economy.

According to the results of the study, it was revealed that both abroad and in Russia there is a growing attention from the state and society to environmental consumption. In particular, the expert survey showed that almost more than half of the respondents noted the high efficiency of the activities of the national project "Ecology". It is expected that in the very near future the business will switch to responsible consumption: it will be forced to focus not only on making a profit, but also on protecting the environment. Accordingly, environmental protection will be implemented by business through the introduction of environmental standards, the introduction of environmental management, the creation of "clean" technologies and circular production, the implementation of waste recycling and disposal processes, etc. activities.

¹³Multiple answers were allowed.

Допускались множественные ответы.

The attitude of the population to SMW was studied based on the model of the individual's pro-ecological behavior [20, p. 16–17]: (1) identification of the behavior to be changed; (2) study of the main indicators influencing this behavior; (3) development and application of intervention tools to change behavior and reduce environmental impact; (4) evaluation of the results of the intervention.

As a result of the conducted survey of the population and experts, it was revealed that in Russia there is still an insufficiently high level of environmental education of the population, which is especially characteristic against the background of insufficiently high socio-economic indicators of people's living standards.

It is shown that the most effective ways of stimulating should include social marketing activities (strengthening the promotion of responsible consumption, intensifying work with the population, holding thematic holidays and contests, etc.) and the introduction of economic incentive tools (utility benefits and reduced payment for HCUS) and punishing consumers (fines for improper collection of SMW).

The authors believe that the study should be continued in terms of further research of consumer behavior in the green economy. In particular, various aspects of the formation and modeling of consumer behavior (both individuals and legal entities) are very interesting and promising in the conditions of Covid-19 restrictions and post-Covid economy, as well as in the conditions of new economic sanctions in connection with the Russian Federation's special military operation in Ukraine.

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УДК 331.2+338.24

ГРНТИ 06.77.71

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Проблемы обращения твердых коммунальных отходов и ответственное потребление в зеленой экономике

Аннотация. Повышение качества жизни населения РФ особенно актуально в зеленой экономике в целом, в сфере ЖКХ, в частности, и в процессе решения проблемы обращения с твердыми коммунальными отходами (ТКО), в особенности. Переход к зеленой экономике строится также и на ответственном поведении потребителя, что является актуальной и сложной задачей, поскольку теоретико-методологическая база исследований здесь еще только формируется. Цель исследования: выявление ключевых проблем обращения ТКО и определение основных проблем ответственного потребления в зеленой экономике. Методы исследования: анализ работ отечественных и зарубежных авторов по заявленной проблематике; опросы населения и экспертов; корреляционный и квалиметрический анализ. Рассмотрены вопросы: (1) ЖКХ, нормативное обеспечение ответственного потребления и проблема обращения ТКО в зеленой экономике; (2) отношение населения к ТКО и проблемы моделирования ответственного потребления в зеленой экономике. Выявлено, что и за рубежом и в России отмечается растущее внимание со стороны государства и общества к ответственному потреблению. Показано, что большинство респондентов отметили высокую эффективность мероприятий национального проекта «Экология». Ожидается, что в самое ближайшее время бизнес будет вынужден вводить экологические стандарты и экологический менеджмент,

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создавать «чистые» технологии, перерабатывать и утилизировать отходы. Отношение населения к ТКО изучали, исходя из модели проэкологического поведения индивида (Морозова С.В., Козлов В.В., 2020): (1) идентификация поведения, подлежащего изменению; (2) исследование основных индикаторов, влияющих на это поведение; (3) разработка и применение инструментов вмешательства в целях изменения поведения и уменьшения воздействия на окружающую среду; (4) оценка результатов вмешательства. Выявлено, что в России наблюдается недостаточно высокий уровень экологической образованности населения, что связано с индикаторами качества жизни. Наиболее эффективными способами стимулирования ответственного потребления являются мероприятия социального маркетинга и введение экономических инструментов поощрения и наказания потребителей.

Ключевые слова: зеленая экономика; качество жизни; экология; ЖКХ; твердые коммунальные отходы (ТКО); обращение ТКО; поведение потребителей; ответственное потребление; проэкологическое поведение

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